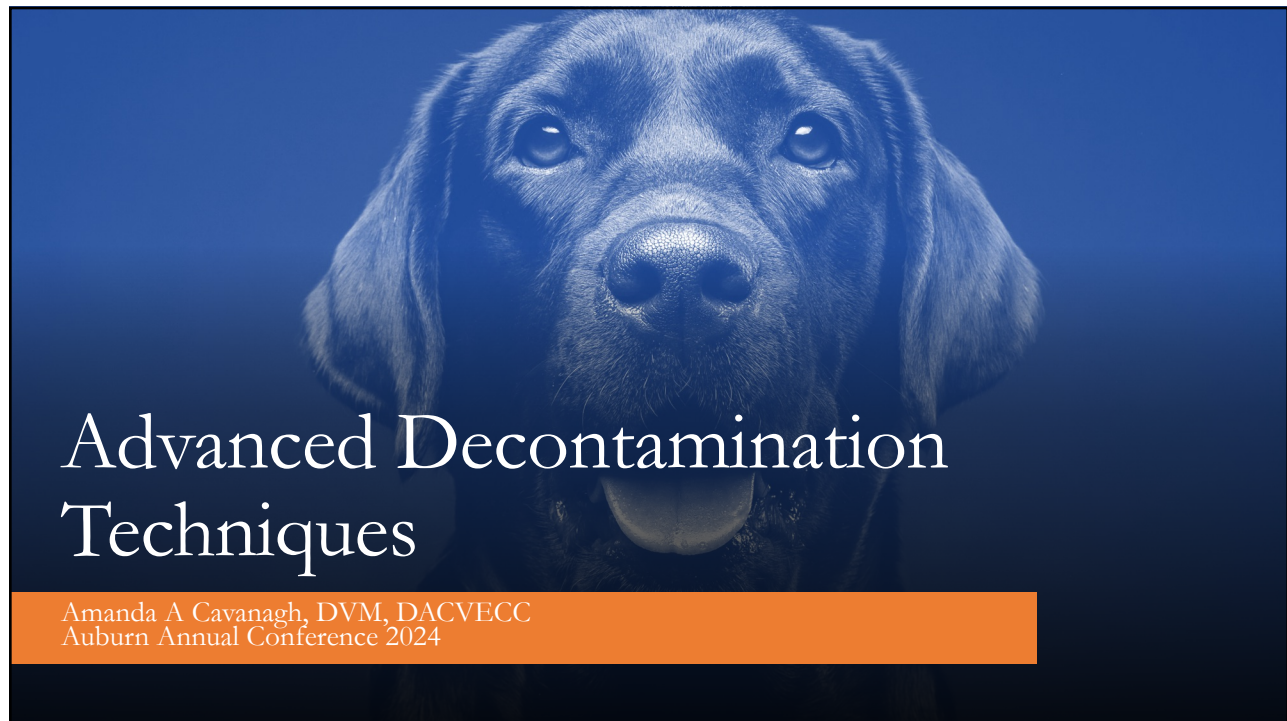
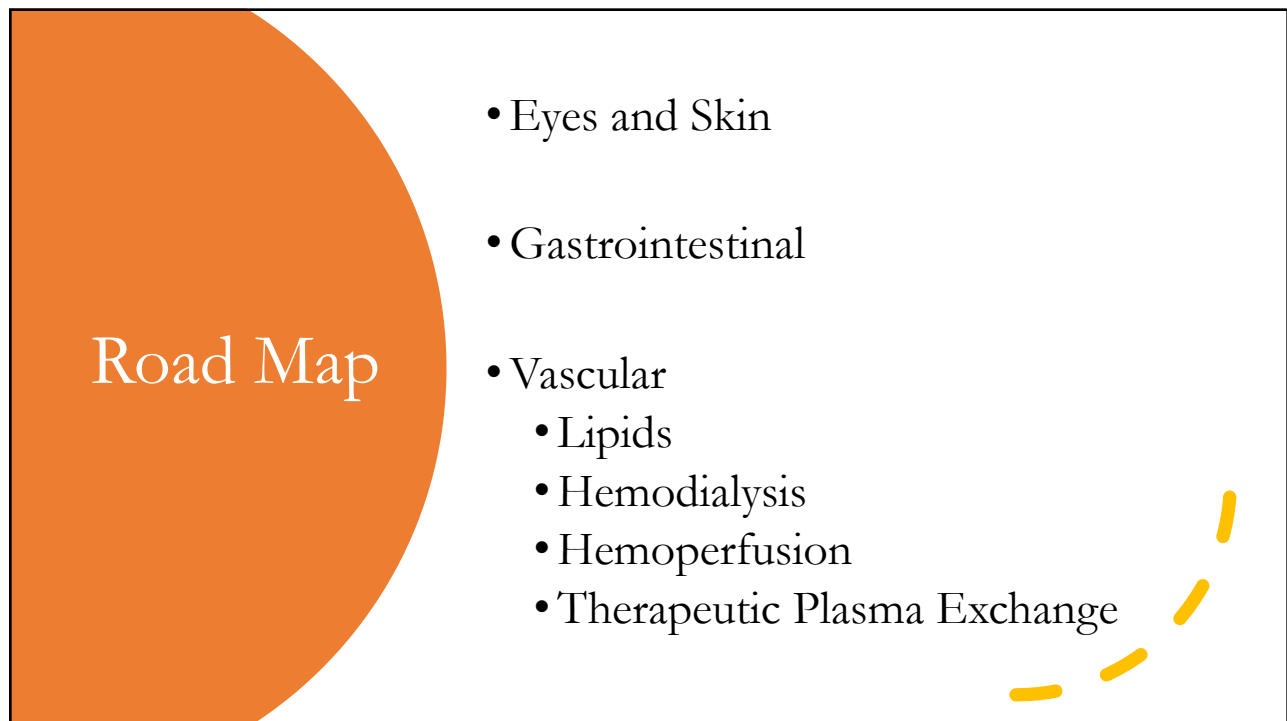




1



2

Decontamination Choices

Mechanism of
Action

Pharmaco-
kinetics

Toxic Dose

3

Ocular Decontamination

- Corrosive or Caustic Chemicals
 - Detergents, Tide Pods, Bleach cleaners
 - Lime
 - Cement dust or paste



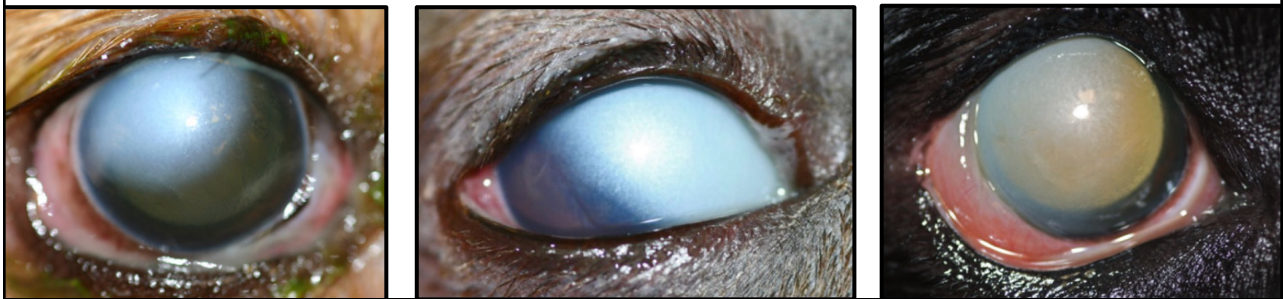
Kawallak, L., et al. JVECC. 2017. 27(2):224-231
Lo et al., JVECC. 2022. 32(4):507

4

Ocular Decontamination

- Corrosive or Caustic Chemicals
 - **At home 15-20 minute lavage** with tap water
 - Corneal edema to dilute chemical in stroma
 - Rinse chemical off hair and skin with water

Busse et al., 2015



5



Kawallak, L., et al. JVECC. 2017. 27(2):224-233

6

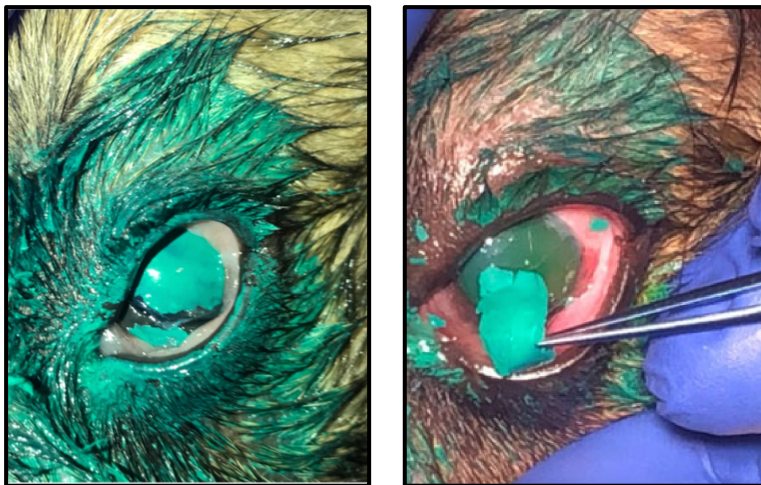
Ocular Decontamination

- Acidic Chemicals
 - Sulfuric Acid in Batteries
 - Nitric Acid in metal cleaners, rust removers and concrete cleaners
 - Nail Polish



7

Acidic Chemicals



- Acids precipitate tissue proteins of the cornea
- Physical barrier to deep penetration
- Superficial corneal ulcer with edema
- Lavage with saline

Kawallak, L., et al. JVECC. 2017. 27(2):224-231
 Lo et al., JVECC. 2022. 32(4):507

8

Ocular Decontamination

- Sedation or Anesthesia
 - **Repeat Gentle Lavage:** 20-minute lavage with 2-3 liters saline
 - Urine pH strips – goal pH 7.5
- Treat ocular and eyelid injury
- E collar



10

When Eyes Melt: 4% Acetylcysteine



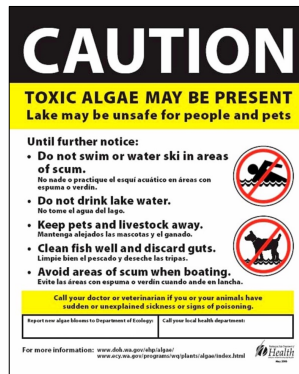
1 ml

+



11

Skin Decontamination



12

Skin Decontamination



- Caustic or Corrosive
 - **Gentle lavage: 20 minutes**
- Oil Based
 - Dish degreasing soap

13

Keys to Bath Success



- Ensure cardiovascular and neurologic stability
- Gloves and eye protection for staff
- Warm patient back to normal temp
- Consider a clip & focal temporary cleanse

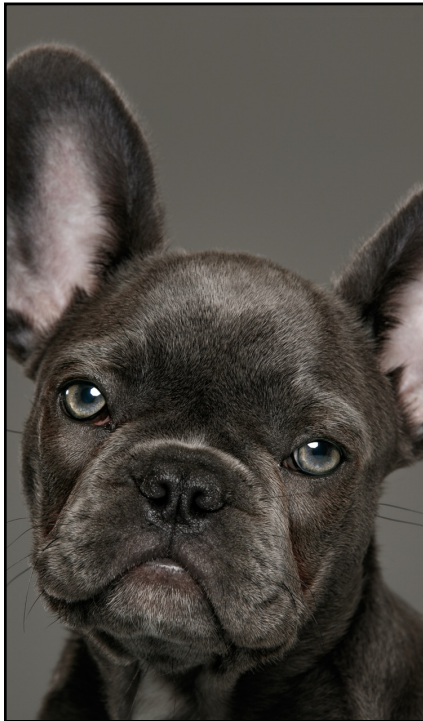
14

Dermal Decontamination

- Was there oral exposure?
 - Emesis
 - Activated charcoal
 - Intravenous lipid emulsion



15



GI Decontamination: Dogs

- **Apomorphine:** 0.02-0.04 mg/kg IV or IM
 - D2 Receptors in the CRTZ
- **Clevor (ropinirole):** ocular drop
 - D2 receptors in the CRTZ

Chen et al., Int J of Neuroscience. 2011. 121:45-52
Sedlacek et al., J Pharm. Ther. 2008. 31

16

GI Decontamination: Cats

- Alpha₂ Adrenergic Agonist
 - **Dexmedetomidine 7-10 mcg/kg IV** or IM
 - Xylazine 0.5-1mg/kg IM or SQ

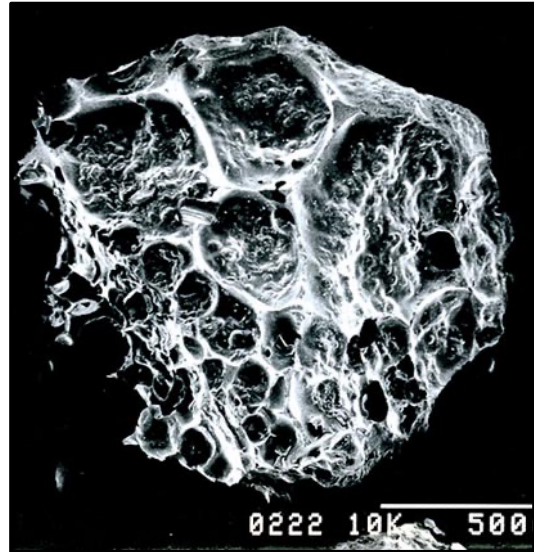


Thawley, VJ. JAVMA. 2015. 247(12):1415-1418
Willey, et al., JAVMA. 2016. 248(8): 923-928
Thies, M., et al. JVECC. 2008. 20

17

Activated Charcoal

- Single Dose 1-5 g/kg PO
- Multi-dose 1-2 g/kg PO
- Combine with food
- Cathartics are out



Koenigshof AM, et al. JVECCS. 2015. 25(5): 606-610.
Wilson HE, et al. JVECC. 2013. 23(3):263-267
Mix et al., JVECC. 2017. 29:616-621

18

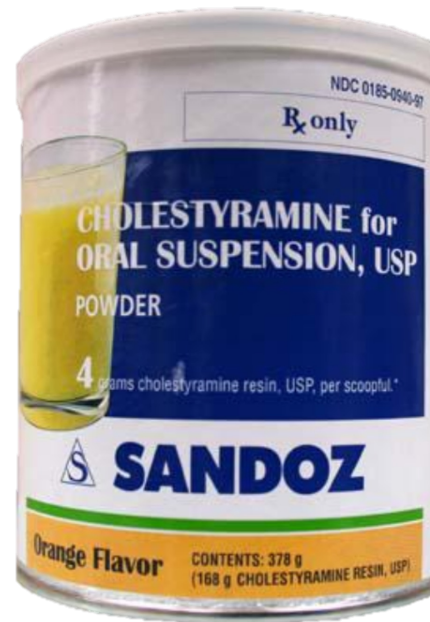
Activated Charcoal

- Unbound Toxins
 - Alcohols
 - Xylitol
 - Heavy metals (iron, zinc)
 - Metaldehyde (slug/snail bait)
 - Corrosive and caustic acids/bases (detergents, bleach)
 - Petroleum products (kerosene)
 - Inorganic toxins (nitrates, ammonia)

19

Cholestyramine

- Enterohepatically recirculated toxins
 - 0.1-1 **grams**/kg q6-8 hours
- Mechanism
 - Binds bile acids to insoluble complexes
- **Caution: may contain xylitol!**



Blackwell's 5 Minute Veterinary Consult Clinical Companion: Small Animal Toxicology. Wiley Blackwell. 2016
<https://www.aspcapro.org/resource/what-know-about-cholestyramine-resin>

20



21

Vascular Decontamination

- Intravenous Lipid Emulsion
- Extracorporeal Therapy
 - Hemodialysis
 - Hemoperfusion
 - Therapeutic Plasma Exchange



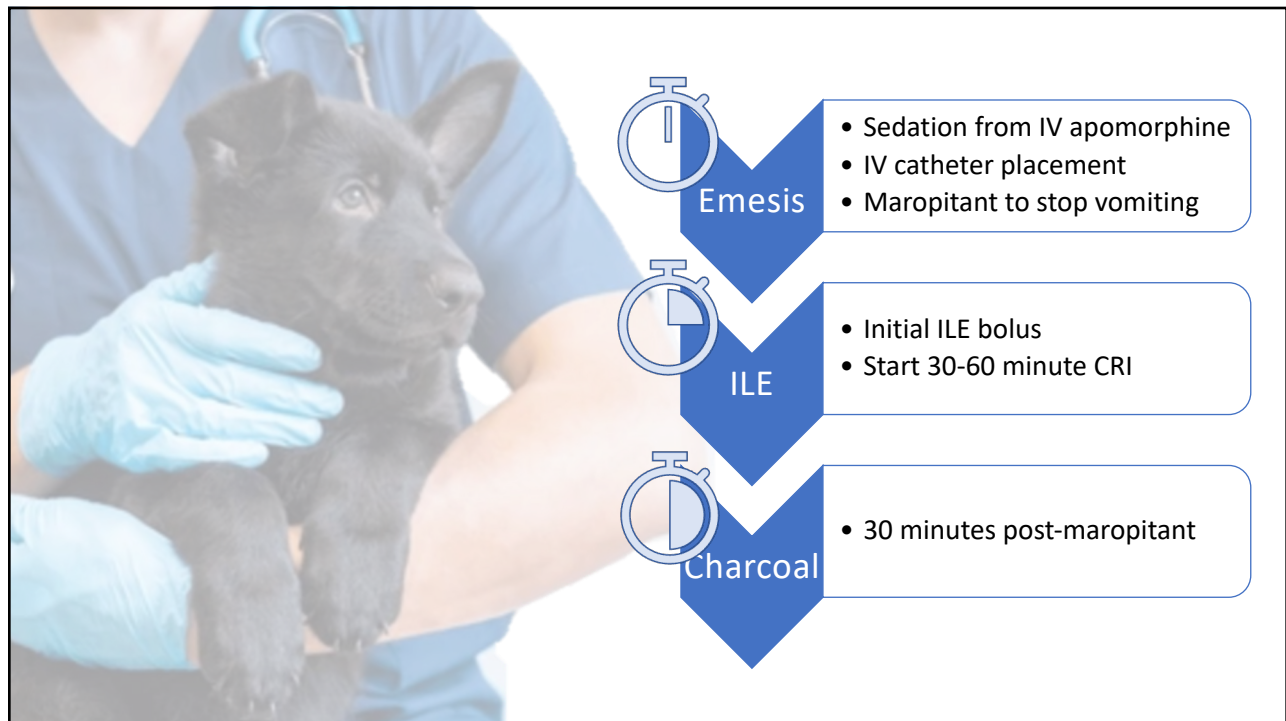
22

GI Decontamination

Emesis if Possible
Gastric Lavage
Activated Charcoal



23



24

Intravenous Lipid Emulsion

- 20% Lipid Emulsion
 - **Iso-osmolar**
- Lipophilic Toxins
- Lipid Sink and Metabolic Theory

Fernandez, AL., et al. JVECC. 2011. 21(4):390-200

25

Intravenous Lipid Emulsion

Lidocaine (reverse cardiovasc collapse)	Pyrethrins permethrins (resolution of signs)	Moxidectin ivermectin (return of vision)	Ibuprofen (100% decreased serum conc)
Naproxen (60%-76% decreased serum conc)	Ca Channel Blockers Beta Blockers	Baclofen	Bromethalin (75% decreased serum conc)
	Tremorgenic mycotoxins (reduced recovery time)	Marijuana Cocaine	

26

Intravenous Lipid Emulsion

- Technique (off label)
 - 2mL/kg IV bolus
 - 0.25 – 0.5 mL/kg/minute CRI for 60 minutes



Fernandez, AL., et al. JVECC. 2011. 21(4):309

27

Intravenous Lipid Emulsion

- Technique
- Re-dose?
 - Clear serum
 - 1.5ml/kg IV bolus q4-6hours
 - 0.5 ml/kg/hour until signs improve
 - Don't exceed 24h



Fernandez, AL., et al. JVECC. 2011. 21(4):309

28

Intravenous Lipid Emulsion

- Dogs (6) and cats (2) with NSAID toxicosis
- Plasma levels of cholesterol and triglycerides
 - Prior to ILE
 - 1 hour post
 - 3 hours post
- No change in cholesterol
- Triglycerides
 - Increase at 1hr
 - 75% of animals return close to normal in 3 hours
 - **Measure to decide on the re-dose**



Daza et al. PLASMA CHOLESTEROL AND TRIGLYCERIDES MONITORING DURING INTRAVENOUS LIPID THERAPY IN PATIENTS INTOXICATED WITH NSAIDS, 2018

29

Intravenous Lipid Emulsion

Effect of treatment with intravenous lipid emulsion (ILE) in 313 dogs and 100 cats with confirmed or suspected poisoning.

	Effect after ILE	Total		Improved clinical condition		Unchanged clinical signs		Worsened clinical condition	
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Dogs	ILE I	313	100.0	234	74.8	66	21.1	13	4.2
	ILE II	76	24.3	64	84.2	11	14.5	1	1.3
Cats	ILE I	100	100.0	54	54.0	42	42.0	4	4.0
	ILE II	20	20.0	13	65.0	7	35.0	—	—

Markert et al., Frontiers. 2023

30



Epstein et al., JAVMA. 2022. 260(6)

Fernandez, AL., et al. JVECC. 2011. 21(4):309

Intravenous Lipid Emulsion

- Adverse Effects
 - 6% dogs: increased risk with ↑ doses
 - 4% cats: no increased risk with ↑ doses

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Intravenous Lipid Emulsion

- Adverse Effects
 - Deactivates other drugs
 - Bacterial contamination, sepsis
 - Hypertriglyceridemia
 - Diminished consciousness
 - V/Q mismatch, apnea, ARDS
 - Bradycardia
 - Corneal lipidosis, uveitis
 - V/D, facial swelling
 - Anemia, thrombocytopenia

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Intravenous Lipid Emulsion

- Extravasation
 - Deep tissue necrosis from fat
- Treatment
 - Warm compress to liquify
 - Dry heat

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Intravenous Lipid Emulsion

- **Overdose**

34

Manual plasma exchange to treat an accidental overdose of intravenous lipid emulsion in a dog with baclofen toxicosis

Steven E. Epstein, DVM*; Kate Hopper, DVM, PhD;

Hypertriglyceridemia

Cardiovascular depression

Hypoglycemia

AKI

Intravascular hemolysis

Coagulopathy

35

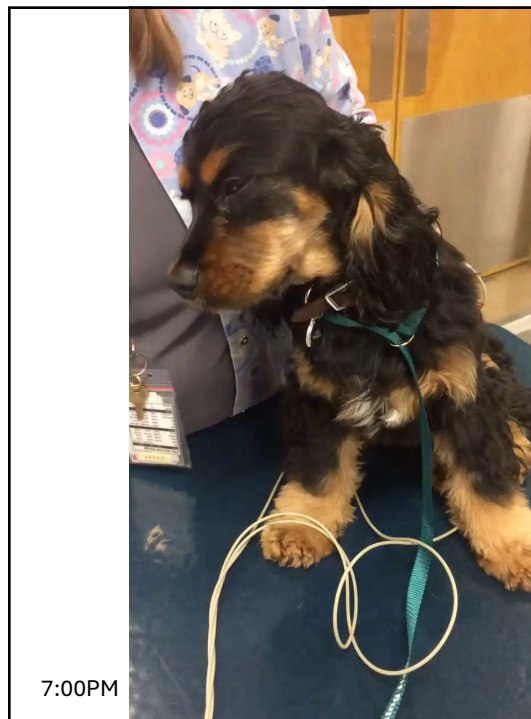


Intravenous Lipid Emulsion

• Overdose

- Heparin 75-250 u/kg SQ q6h
- Therapeutic plasma exchange

36



Use of Intravenous Lipid Emulsion in Dogs With Suspected Tremorgenic Mycotoxicosis: 53 Cases

Foteini Korpou DVM, PGcert(CVP) MRCVS^{1*}

Aoife O'Sullivan MVB CertAVP(ECC) MRCVS²

Laura Troth BVMedSci BVM BVS MRCVS²

Sophie Adamantos BVSc CertVA DACVECC DipECVECC MRCVS FHEA¹



37



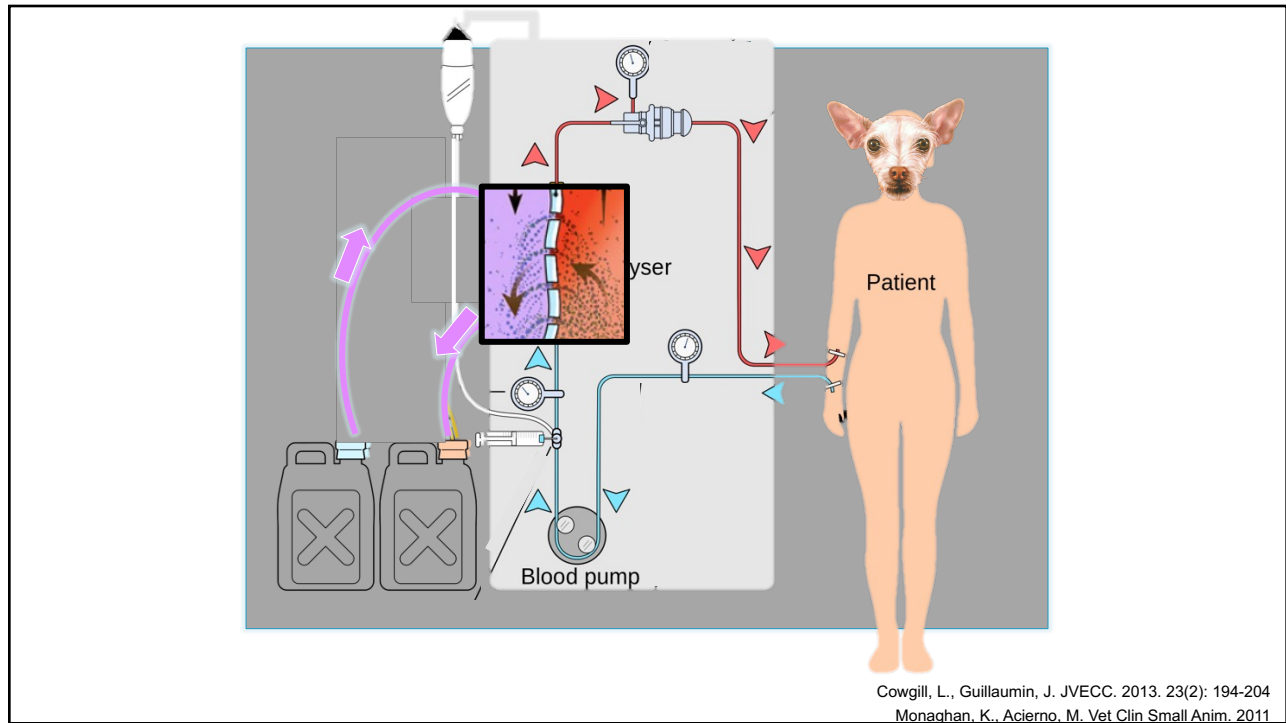
38

Extracorporeal Therapies

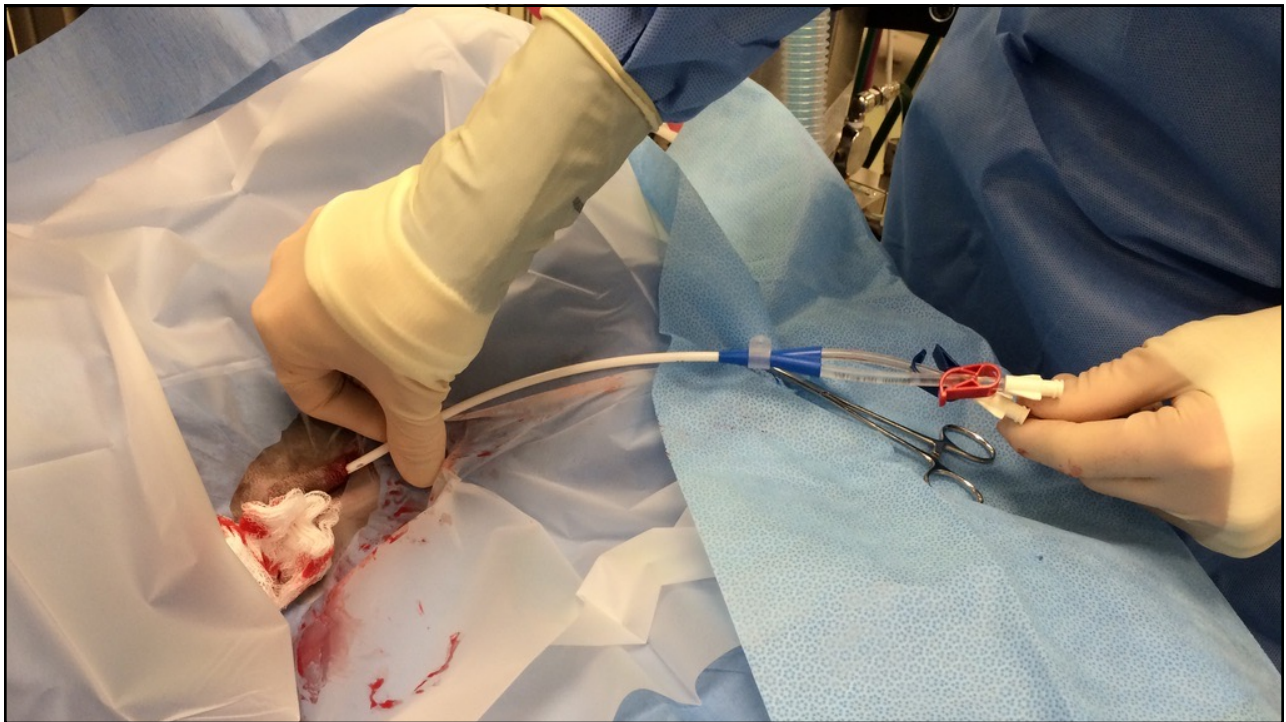
- Indications
 - Severe, progressive signs
 - Severe consequences
 - Improved plasma clearance
 - Delayed medical treatment
 - Absence of antidotes
 - Acid Base/lyte abnormalities



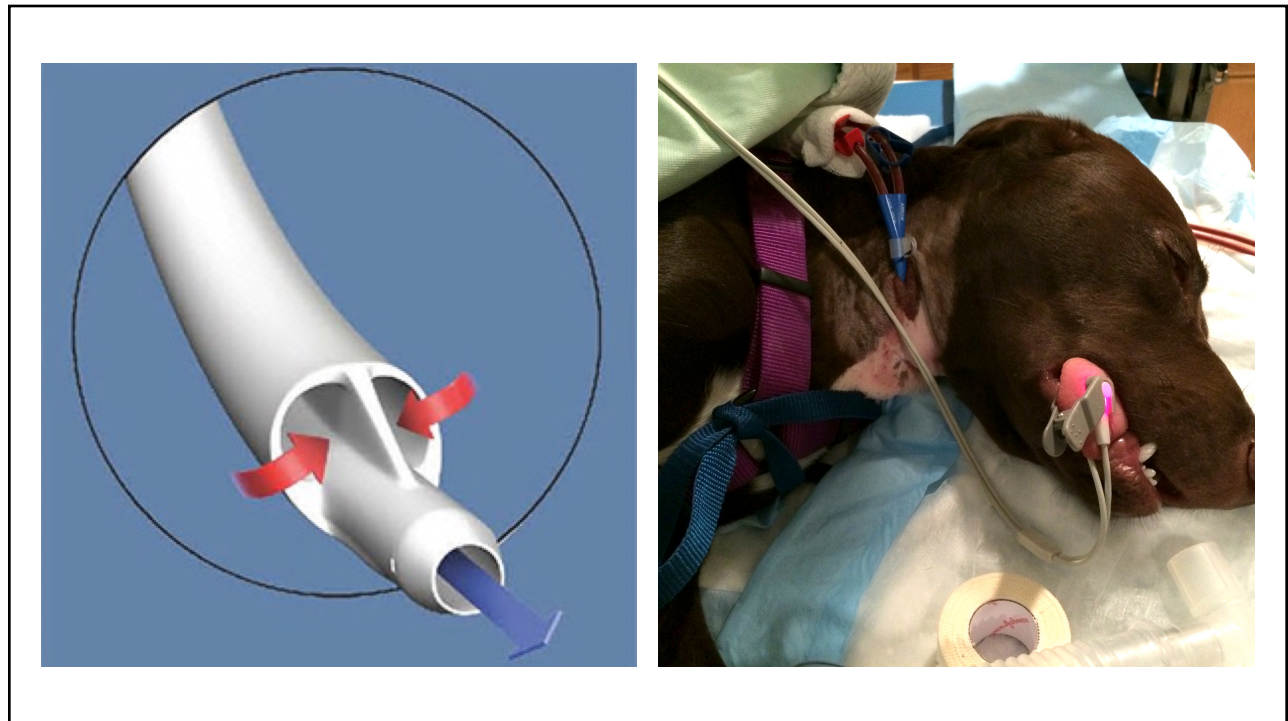
40



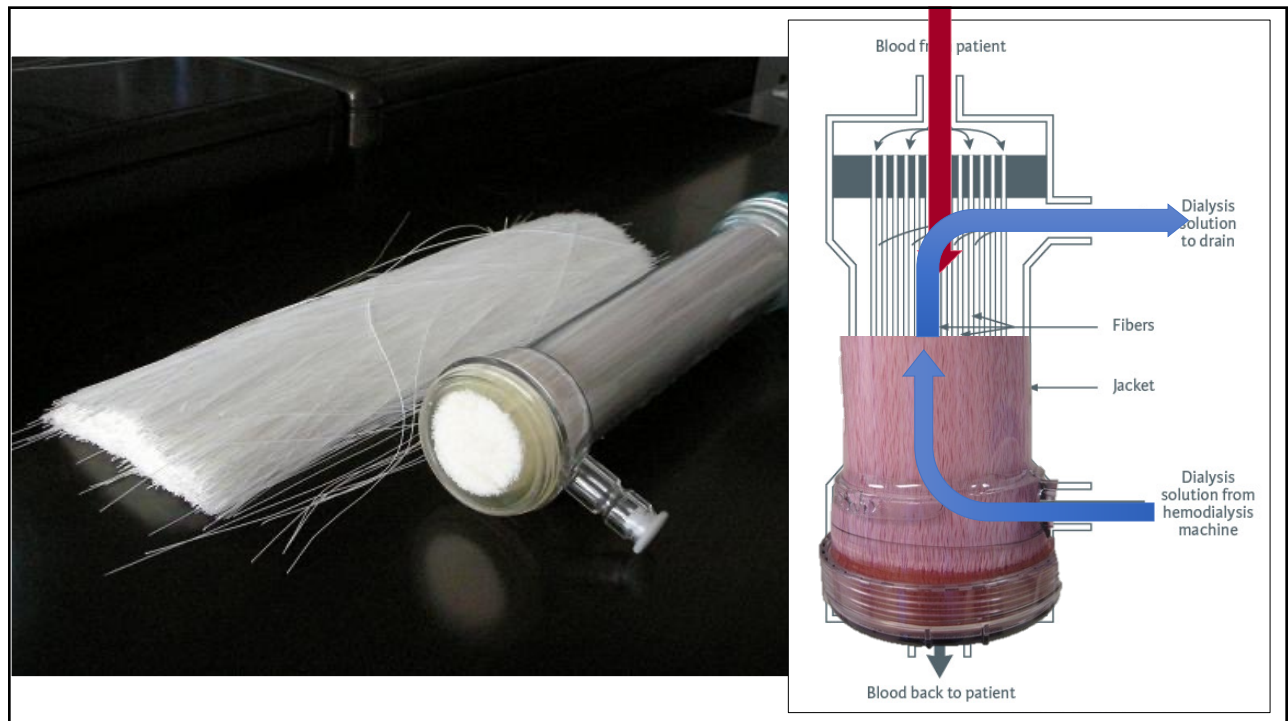
41



42



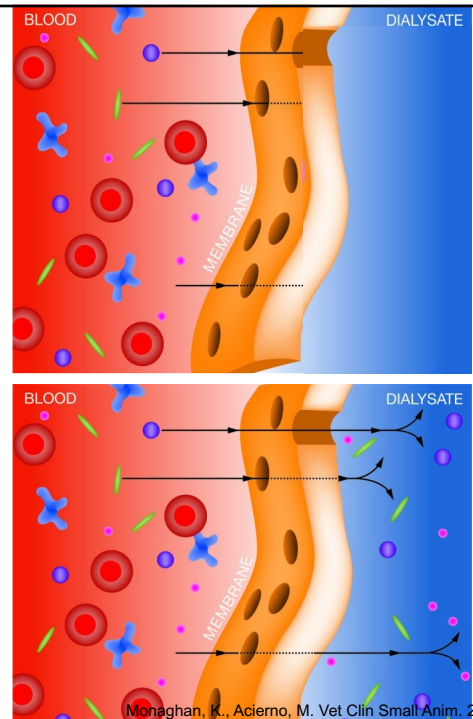
43



44

Hemodialysis

- Ideal Toxin
 - Small molecular size
 - Low protein binding
 - Water soluble
 - Low Vd
 - No first pass hepatic metabolism



Monaghan, K., Acierno, M. Vet Clin Small Anim. 2011

45

Hemodialysis

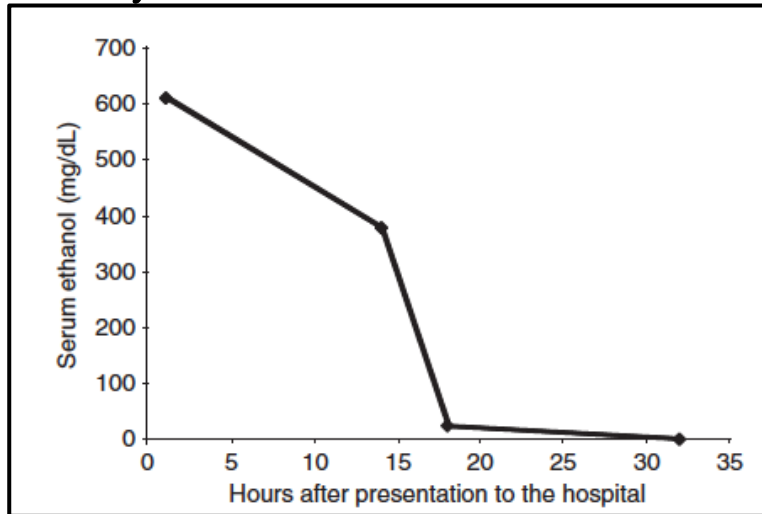
- Ideal Toxin
 - Small molecular size
 - Low protein binding
 - Water soluble
 - Low Vd
 - No first pass hepatic metabolism



Monaghan, K., Acierno, M. Vet Clin Small Anim. 2011

46

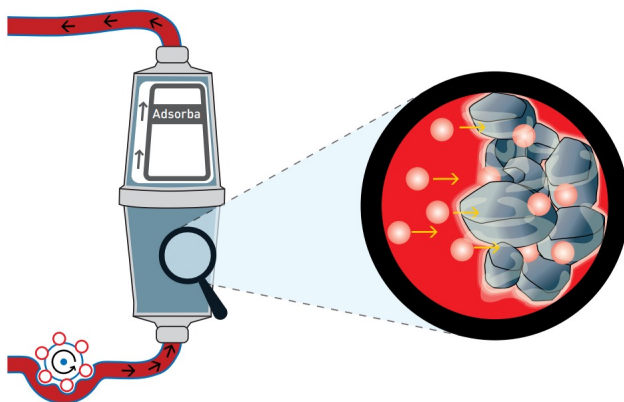
Hemodialysis



Keno, L., Langston, K. JVECC. 2011

47

Hemoperfusion



- Adsorbent
- Nonselective, irreversible binding
 - Large MW
 - Highly protein bound
 - Lipid soluble
 - Low Vd

Ghannoum, M., et al. Seminars in Dialysis. 2014. 27(4): 350-361
https://portal.baxter.semcon.com/sites/portal/files/gambro/list_content/file/im_hp.pdf

48

Hemoperfusion

- Ultra-thin surface coat
- Challenges
 - Priming volume
 - Anticoagulation
 - Saturation



50



51



52



53

Therapeutic Plasma Exchange

- Separate blood to components
 - Discard plasma
 - Replace with donor plasma, crystalloids, colloids
- Remove toxin and byproducts

RBC

WBC
and
Platelets

Plasma

Schutt, RC, et al. *Seminars in Dialysis*. 25(2): 201-206
Ward, DM. *Symposium on Plasma Exchange for CNS Demyelinating Diseases*. May 31, 2014.

54

DOI: 10.1111/jvim.15420

Journal of Veterinary Internal Medicine Official Journal of the American College of Veterinary Internal Medicine

STANDARD ARTICLE

Use of therapeutic plasma exchange to treat nonsteroidal anti-inflammatory drug overdose in dogs

Melisa G. Rosenthal¹ | Mary A. Labato²

JAVMA **AVMA**

Manual plasma exchange to treat an accidental overdose of intravenous lipid emulsion in a dog with baclofen toxicosis

Steven E. Epstein, DVM^{*}; Kate Hopper, DVM, PhD; Kate S. Farrell, DVM

CASE REPORT

Successful management of severe carprofen toxicity with manual therapeutic plasma exchange in a dog

Miranda Buseman DVM | April E. Blong DVM, DACVECC | Rebecca A. L. Walton DVM, DACVECC

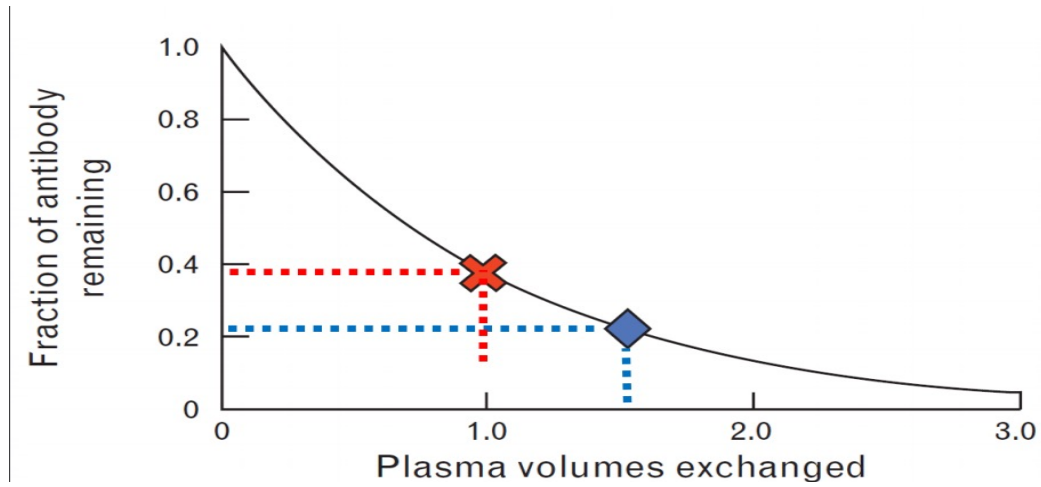
Therapeutic Apheresis
4(4):306-312; Blackwell Science, Inc.
© 2000 International Society for Apheresis

**Plasmapheresis in the Treatment of Amanita Phalloides Poisoning:
II. A Review and Recommendations**

*S. Jander, †J. Bischoff, and ‡B.G. Woodcock

55

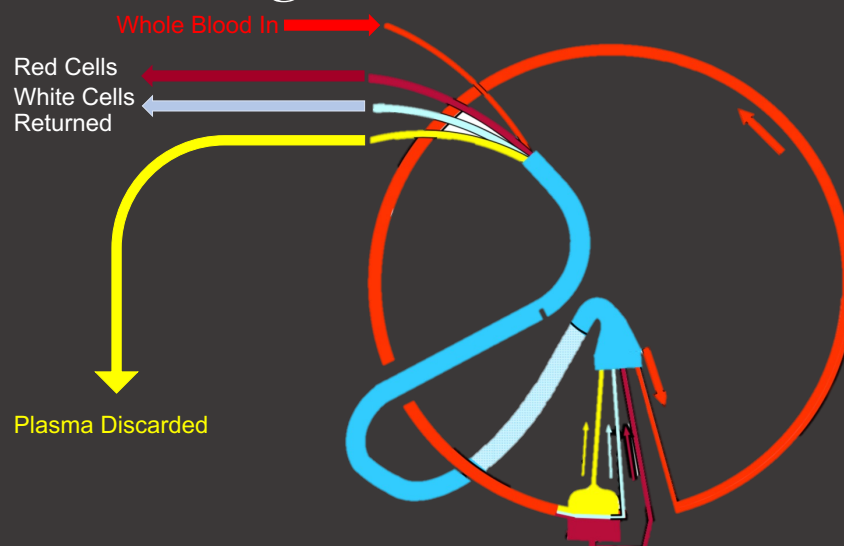
Therapeutic Plasma Exchange



Ward, DM. Symposium on Plasma Exchange for CNS Demyelinating Diseases. May 31, 2014.
Roman PEF, et al. Curr Opin Anesthesiol 2014, 27:57-64

56

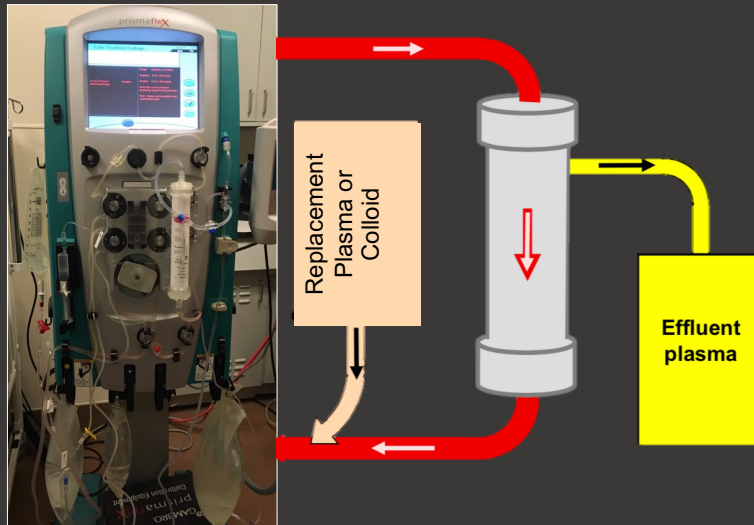
TPE: Centrifugation



Ward, DM. Symposium on Plasma Exchange for CNS Demyelinating Diseases. May 31, 2014.

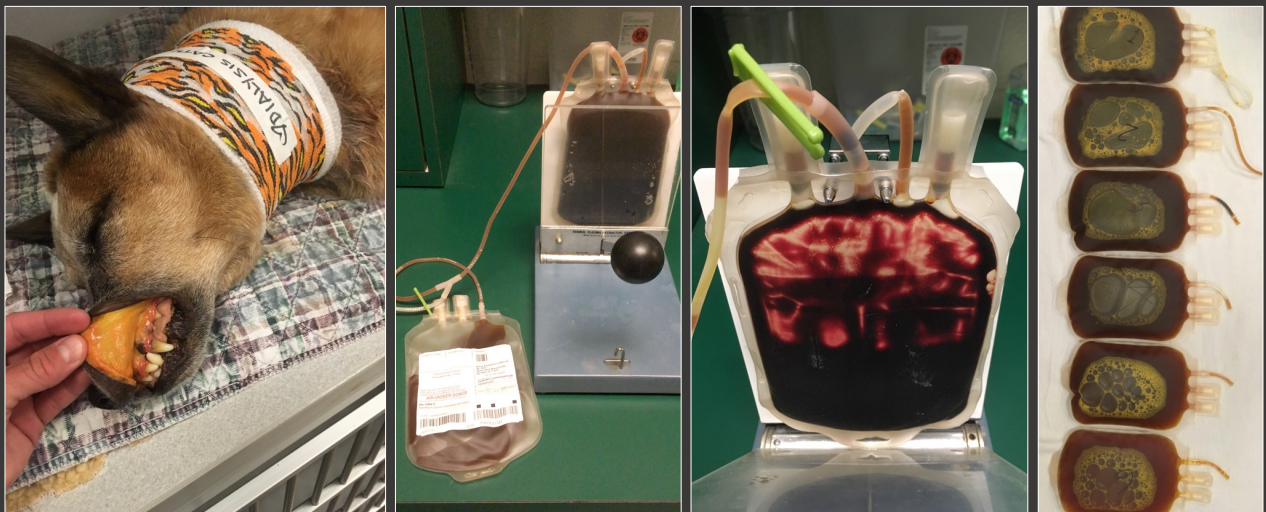
57

TPE: Filtration



58

TPE: Manual Centrifugation



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Extracorporeal Therapies in the Emergency Room and Intensive Care Unit



J.D. Foster, VMD

Table 1
List of common veterinary intoxications grouped by effective ECTR modality

Hemodialysis or Hemofiltration	Charcoal HP (Often Performed in Combination with HD)	TPE
Acetaminophen	Amanita toxins	Amanita toxins
Aspirin	Baclofen ⁵⁶	Carprofen ⁶³
Aluminum ⁶⁷	Cannabinoids ⁵⁷	Deracoxib ⁵⁴
Baclofen	Cyclosporine ⁵⁸	Hyperbilirubinemia ^{64,65}
Bromides	Ibuprofen ⁴³	Ibuprofen ^{7,54}
Caffeine	Metaldehyde ⁵⁹	Meloxicam ⁴⁹
Diethylene glycol	Methotrexate ⁶⁰	Naproxen ^{54,66}
Ethanol ⁵⁵	Paraquat ⁶¹	Vincristine
Ethylene glycol ³⁴	Pentobarbital	
Isopropyl alcohol	Phenobarbital ⁶²	
Lithium		
Mannitol		
Metaldehyde ⁴⁹		
Methanol		
Metformin		
Methyl alcohol		
Theophylline		

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Tips for Referring

- Refer cases early
 - 8-12 hour maximum to intervene
- Don't draw blood from the jugular veins
- Call your local ECT specialists for prices and availability



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Conclusions

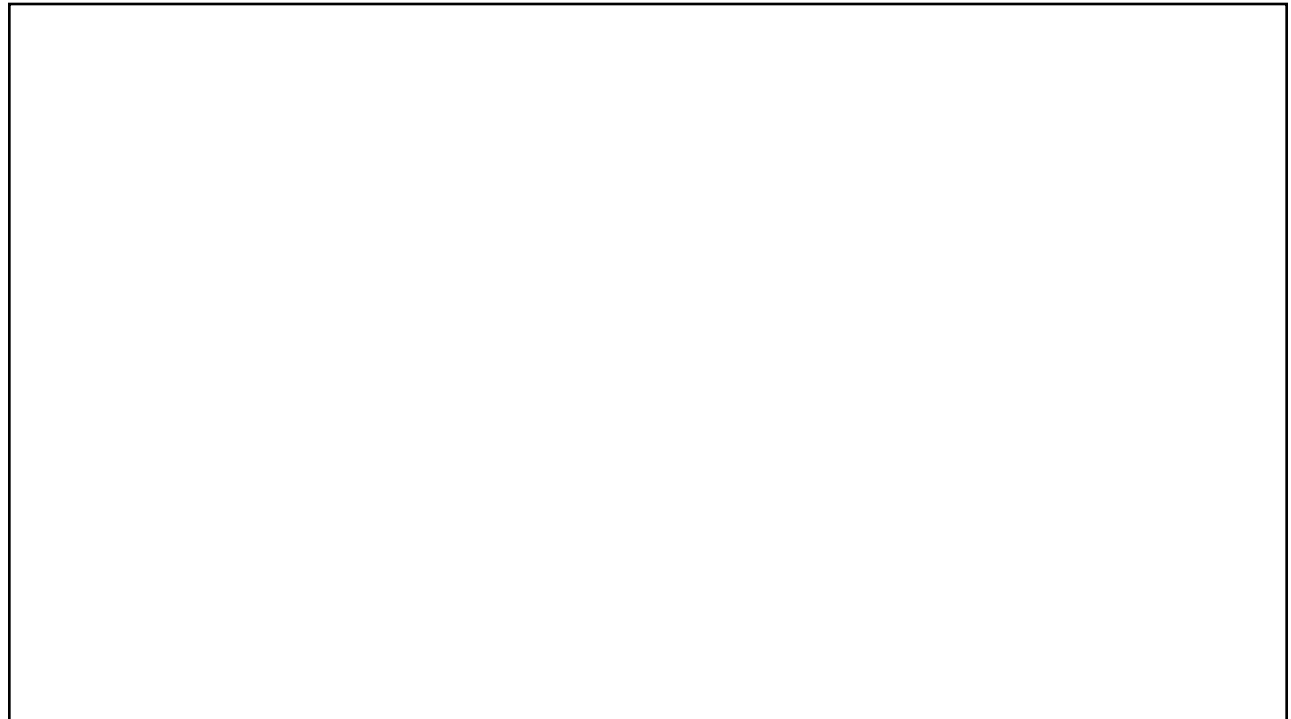
- Rapid and early intervention is key
- Toxin MOA and pharmacokinetics matter
- GI decontamination remains essential, even with extracorporeal therapy



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63



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Gastrointestinal
Decontamination

65

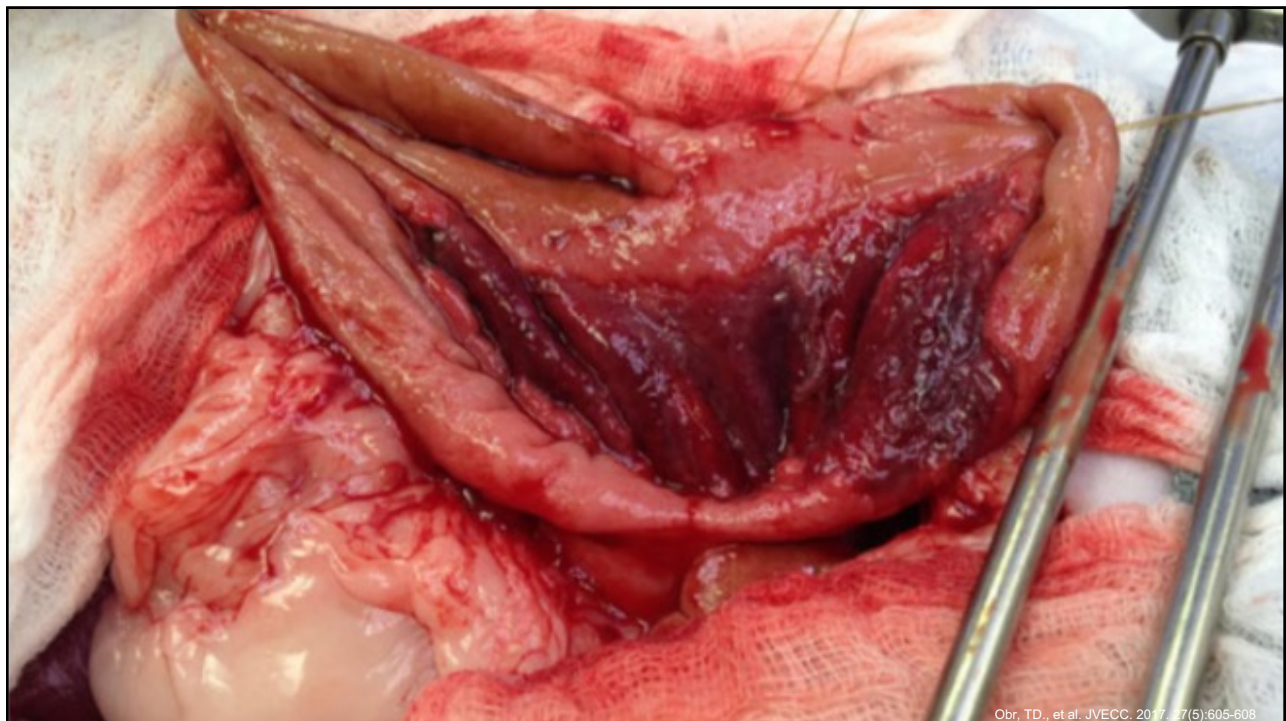


At Home Emesis

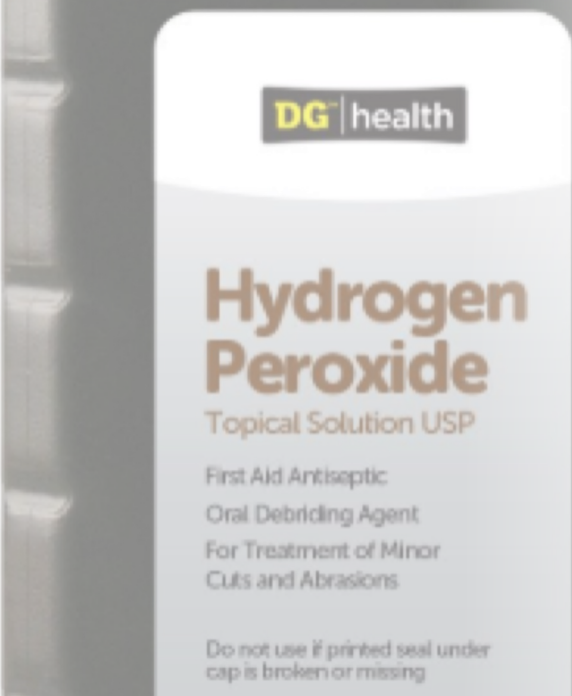
- Not Recommended
- **Fizzy** Hydrogen Peroxide 3%
 - 1-2 mL/kg
 - Max 50mL total per dog
- Nothing safe for cats

Khan, SA, et al. JAVMA. 2012. 241: 1179-1184
Thawley, VJ. JAVMA. 2015. 247(12):1415-1418

66



67

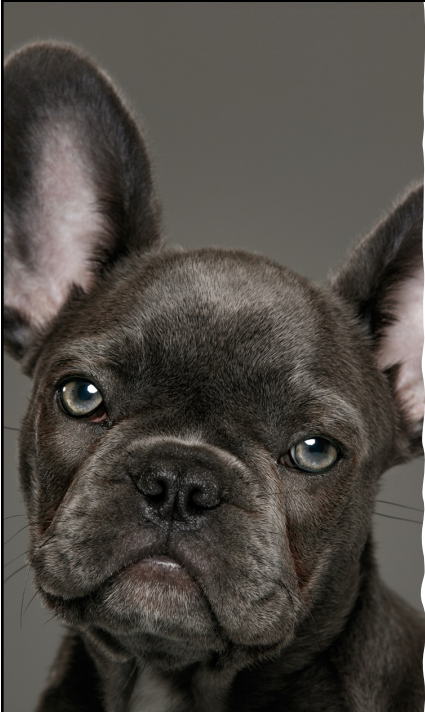


Hydrogen Peroxide for Emesis

- Experimental Study
- Significant Lesions
 - **Mild esophageal 33%**
 - **Significant gastric 100%**
 - **Moderate duodenal 83%**

Neidzwecki, AH., et al. JVECC. 2017. 27(2):178-184

68



GI Decontamination: Dogs

- Apomorphine: 0.02-0.04 mg/kg IV or IM
 - D2 Receptors in the CRTZ
- Reverse
 - Sedation: Naloxone
 - Vomiting: Maropitant
 - **Caution with ondansetron (?)**

Chen et al., Int J of Neuroscience. 2011. 121:45-52
Sedlacek et al., J Pharm. Ther. 2008. 31

69



GI Decontamination: Dogs

- **Tranexamic Acid:** 50mg/kg IV
 - Anti-fibrinolytic agent
 - Tachykinin neurokinin 1 receptors
- Reverse
 - Vomiting: Maropitant

Kantyka et al., JVECC. 2017. 30:436-441

Kenshuke et al., J Vet Med Sci. 2017. 79(12)

70

GI Decontamination: Dog

- **Clevor (ropinirole): ocular drop**
 - D2 receptors in the CRTZ
- Adverse Effects
 - Hypotension
 - Tachycardia
 - Tremors, ataxia

Body weight in kilograms	Body weight in pounds	Total number of eye drops	Example administration
1.8 - 5	4 - 11.1	1	1 drop into either left or right eye
5.1 - 10	11.2 - 22.1	2	1 drop each eye
10.1 - 20	22.2 - 44.1	3	2 drops in one eye and 1 drop in the other eye
20.1 - 35	44.2 - 77.2	4	2 drops in each eye
35.1 - 60	77.3 - 132.3	6	An initial dose of 2 drops in each eye, followed 2 minutes later by 1 drop in each eye
60.1 - 100	132.4 - 220.5	8	An initial dose of 2 drops in each eye, followed 2 minutes later by 2 drops in each eye

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GI Decontamination: Dogs

- Vomiting
 - **Metoclopramide**
 - Maropitant
- Dopaminergic Effect:
 - **Metoclopramide**

72

CASE REPORT

Veterinary Emergency & Critical Care WILEY

Gastrointestinal obstruction secondary to activated charcoal granule impaction in a dog

Kate S. Farrell DVM, DACVECC¹ | Jamie M. Burkitt-Creedon DVM, DACVECC² |
 Laura G. Osborne BVSc, DACVECC¹ | Erin A. Gibson DVM¹ | Anna M. Massie DVM,
 DACVS-SA¹

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